World's largest tropical peatland subsidence study published

Land subsidence presents a challenge for the long-term management of agricultural and forest plantations on tropical peatlands. Over time, subsidence increases the risk of periodic flooding or inundation of land, and may lead to a reduction in productivity. Subsidence results from a combination of compaction (shrinkage) of the dry peat, and accelerated decomposition following its exposure to oxygen, which contributes to CO_2 emissions from drained peatlands.

APRIL, one of Indonesia's largest pulp and paper production businesses, and its long-term supply partners, manage around 584,000 ha of peatland in Riau, Sumatra, which is close to 5% of the total peat area of Indonesia. Of this area, around 45% is managed for fibre production as Acacia plantations, and 55% is conserved as native forest. Since 2007, APRIL has been monitoring an expanding network of subsidence poles, now numbering over 400, throughout their plantation and native forest concessions [Figure 1]. As part of the work of APRIL's Independent Peat Expert Working Group, a scientific team led by Prof Chris Evans of the UK's Centre for Ecology and Hydrology, supported by Indonesian, UK and Finnish scientists and by APRIL's own research team, have recently published an analysis of the first ten years of measurements from this network in the international journal Geoderma [https://doi.org/10.1016/j.geoderma.2018.12.028]. The dataset analysed, containing over 2000 site-years of measurements, is by far the largest ever published, and provides new insights into the effects of plantation forestry management on tropical peat subsidence. The data was also compared to previous measurements from Southeast Asia, including industrial oil palm and smallholder plantations, and from Europe and North America.

The analysis confirms that peat subsidence is occurring in APRIL's fibre plantations, at an average rate of 4.3 cm yr^{-1}. Subsidence rates are similar within 300m forest 'buffer zones' surrounding the plantations, but lower in forest areas that are more distant from the plantations [Figure 2]. Variations in subsidence rate were related to mean water table depth, which was more influential than peat depth, plantation age or vegetation type. Subsidence rates were typically higher than in cooler Northern Hemisphere peatlands experiencing similar levels of drainage, but typical subsidence rates of 1-2 cm yr^{-1} still present challenges for drainage-based agriculture on peat in Europe and North America.

The study contributes scientific evidence in support of Indonesian Government policies to mitigate greenhouse gas emissions from peatlands by water table regulation within set depths. Although growing economically productive crops at raised water levels remains a significant challenge, the results of the study suggest that the government regulations reducing average water table depths could reduce current subsidence rates, and associated CO_2 emissions due to peat decomposition. The data from this study suggests a 40 cm average water table could reduce subsidence rates by around 25-30%. APRIL is now running field trials of Acacia cultivation at higher water levels, evaluating the performance of a range of water-tolerant native species as alternative fibre sources, and monitoring exchange of greenhouse gases from three 'flux towers' representing different land areas under APRIL's stewardship. These monitoring programmes seek to understand and mitigate peat subsidence and reduce net greenhouse gas emissions from managed peatland landscapes.

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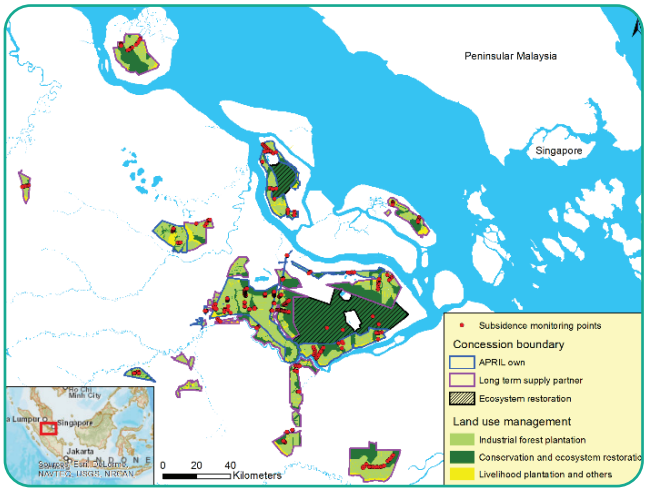
Plantation and monitoring site map



- Subsidence monitoring points

Concession boundary
- APRIL own
- Long term supply partner
- Ecosystem restoration

Land use management
- Industrial forest plantation
- Conservation and ecosystem restoration
- Livelihood plantation and others

Mean measured subsidence in APRIL's concession areas

'Forest edge' is defined as monitoring points within 300m of the plantation boundary, and **'forest interior'** as monitoring points more than 300m from plantations. Error bars show the standard error of the mean for each category.

This assessment was undertaken by a team of Indonesian and international scientists, and was led by Professor Chris Evans, a research scientist at the UK's Centre for Ecology and Hydrology (cev@ceh.ac.uk). The study forms part of the ongoing work of the Independent Peat Expert Working Group (IPEWG), which provides objective science-based advice to APRIL on responsible peatland management across its plantation and native forest concessions. The IPEWG is chaired by Dr Ruth Nussbaumm, Co-director of Proforest (Ruth@proforest.net).